

PATENT COOPERATION TREATY

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MAY 02 2005

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

FAHMI, Tarek
12400 Wilshire Boulevard 7th Floor
Los Angeles CA 90025
UNITED STATES OF AMERICA

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

LOS ANGELES

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

ENTERED

MAY 03 2005

STATUS DB-LA

(PCT Rule 44.1)

Date of mailing
(day/month/year)

27/04/2005

Applicant's or agent's file reference

6317P097PCT

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/US2004/041884

International filing date
(day/month/year)

10/12/2004

Applicant

APPLIED MATERIALS ISRAEL, LTD.

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Cornelia Schulze

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 6317P097PCT	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2004/041884	International filing date (day/month/year) 10/12/2004	(Earliest) Priority Date (day/month/year) 10/12/2003
Applicant APPLIED MATERIALS ISRAEL, LTD.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box II).

3. ☐ **Unity of invention is lacking** (see Box III).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 5

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

- b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2004/041884

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

A method for evaluating a feature, consisting of receiving an image of the feature and determining respective coordinates of a plurality of points on an edge of the feature in the image. A figure having a non-circular non-linear shape is fitted to the plurality of points, and respective distances between the plurality of points and the figure are determined. A roughness parameter for the feature is computed in response to the respective distances. The methods finds application in the analysis of critical dimensions (CD) of integrated circuits and, particulary, in the measurement of the edge roughness of their features and components as imaged by means of eg. the electron scanning microscopy (SEM) .

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/041884

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01N21/956 G01B11/24 H01L21/66 G03F7/20 G06T7/00
G01N23/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01N G01B H01L G03F G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 6 480 807 B1 (MIYANO YUMIKO) 12 November 2002 (2002-11-12)</p> <p>column 2, line 61 - column 3, line 3 column 3, lines 20-28 column 6, lines 7-23 column 8, lines 5-45</p> <p>----- -/--</p>	<p>1-15, 17-31, 33-38</p>



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

* & * document member of the same patent family

Date of the actual completion of the international search

15 April 2005

Date of mailing of the international search report

27/04/2005

Name and mailing address of the ISA

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Authorized officer

Navas Montero, E

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/041884

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	LEE TAE YONG ET AL.: "Experimental methodology of contact edge roughness on sub-100 nm pattern" PROCEEDINGS OF SPIE: METROLOGY, INSPECTION, AND PROCESS CONTROL FOR MICROLITHOGRAPHY XVIII, vol. 5375, 24 May 2004 (2004-05-24), pages 623-632, XP002324803 USA the whole document	1-5, 7-15, 17-21, 23-31, 33-38
X	BUNDAY BENJAMIN D. ET AL.: "CD-SEM Measurement of Line Edge Roughness Test Patterns for 193 nm Lithography" PROCEEDINGS OF SPIE: PROCESS AND MATERIALS CHARACTERIZATION AND DIAGNOSTICS IN IC MANUFACTURING, vol. 5041, July 2003 (2003-07), pages 127-141, XP002324804 USA page 129, lines 1-31 page 133, lines 5-8	16,32
A	EP 1 279 923 A (HITACHI, LTD) 29 January 2003 (2003-01-29) the whole document	1,16,17, 33-38

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/041884

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 6480807	B1	12-11-2002	JP	2001091231 A	06-04-2001
EP 1279923	A	29-01-2003	JP	2003037139 A	07-02-2003
			EP	1279923 A2	29-01-2003
			US	2003021463 A1	30-01-2003

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/US2004/041884

International filing date (day/month/year)
10.12.2004

Priority date (day/month/year)
10.12.2003

International Patent Classification (IPC) or both national classification and IPC
G01N21/956, G01B11/24, H01L21/66, G03F7/20, G06T7/00, G01N23/22

Applicant
APPLIED MATERIALS ISRAEL, LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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D-10958 Berlin
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Authorized Officer

Navas Montero, E

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2004/041884

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material:
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing:
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. II Priority

1. ☒ The validity of the priority claim has not been considered because the International Searching Authority does not have in its possession a copy of the earlier application whose priority has been claimed or, where required, a translation of that earlier application. This opinion has nevertheless been established on the assumption that the relevant date (Rules 43bis.1 and 64.1) is the claimed priority date.
2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43bis.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.
3. Additional observations, if necessary:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2004/041884

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	6, 12, 15, 16, 22, 28, 31, 32, 34, 37
	No: Claims	1-5, 7-11, 13, 14, 17-21, 23-27, 29, 30, 33, 35, 36, 38
Inventive step (IS)	Yes: Claims	
	No: Claims	1-38
Industrial applicability (IA)	Yes: Claims	1-38
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item VIII

Certain observations on the international application

- 1 Although **claims 1, 16, 17 and 32 to 38** have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and, to some extent, in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of **Article 6 PCT**.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 2 Reference is made to the following documents:
D1: US-B1-6 480 807 (MIYANO YUMIKO) 12 November 2002 (2002-11-12); and
D2: BUNDAY BENJAMIN D. ET AL.: "CD-SEM Measurement of Line Edge Roughness Test Patterns for 193 nm Lithography" PROCEEDINGS OF SPIE: PROCESS AND MATERIALS CHARACTERIZATION AND DIAGNOSTICS IN IC MANUFACTURING, vol. 5041, July 2003 (2003-07), pages 127-141, XP002324804 USA.
- 3 The present application does not meet the criteria of **Article 33(1) PCT**, because the subject-matter of **independent claims 1, 17, 33, 35, 36 and 38** is not novel in the sense of **Article 33(2) PCT**, and because the subject-matter of **independent claims 16, 32, 34 and 37** is not inventive within the meaning of **Article 33(3) PCT**.
- 3.1 As regards **claim 1** document D1 discloses a method for evaluating a feature (cf. col. 2, lines 55 and 56), comprising:
- receiving an image of the feature (cf. col. 2, lines 63 and 64);
 - determining respective coordinates of a plurality of points on an edge of the feature in the image (cf. col. 7, line 66 to col. 8, line 3);
 - fitting a figure having a non-circular non-linear shape to the plurality of points, determining respective distances between the plurality of points and the figure;

and computing a roughness parameter for the feature in response to the respective distances (cf. col. 8, lines 43 to 45).

3.2 Corresponding objections apply to the related **claim 17** as well as to remaining independent **claims** on file.

4 **Dependent claims 2 to 5, 7 to 11, 13, 14, 18 to 21, 23 to 27, 29 and 30** are not novel in the sense of **Article 33(2) PCT**. **Dependent claims 6, 12, 15, 22, 28 and 31** are not inventive within the meaning of **Article 33(3) PCT**.

4.1 Document D1 further discloses the additional subject-matter of **claims: 2 to 4 and 18 to 20¹, 5 and 21** (cf. col. 8, lines 27 to 31), **7 to 11 and 23 to 27** (cf. col. 1, lines 16 to 23) and **13, 14, 29 and 30** (cf. col. 8, lines 43 to 45).

4.2 The filtering of frequencies (deriving from spatial frequencies of known origin) in response to a process used to form the feature in accordance with **claims 6 and 22** appears to be straightforward for the skilled person.

4.3 Document D1 discloses the determination of a nominal shape of the figure (cf. col. 8, lines 5 to 9), the additional step of averaging some of the plurality of points (to smooth the shape) in accordance with **claims 12 and 28** is well known in the image processing field and cannot be considered inventive.

4.4 As regards the additional subject-matter of **claims 15 and 31**, the skilled person would make use of the method and apparatus of D1 also for features stemming from a reticle, a part of it or a cast of a structure.

¹ The additional subject-matter of these claims relates to the usual algorithms in roughness determination (see e.g. par. 2 of D2) and are considered to be disclosed by D1 to the person skilled in the art.